Chapter 6
PROPOSED MINIMUM FLOW CRITERIA

PROPOSED CRITERIA

As a result of the MFL criteria development process described in **Chapter 4** and **Chapter 5** of this document, District staff recommend a minimum mean monthly flow of more than 28 cfs from the North and South Forks of the St. Lucie River combined to maintain sufficient salinities in the St. Lucie Estuary. The ***harm*** criteria is exceeded when flows fall below the 28-cfs minimum for two consecutive months during the dry season (November through April). ***Significant harm*** occurs if the harm criteria are exceeded for two consecutive years. To protect low-salinity areas in the upper reaches of the North and South Forks, these flows should be distributed to provide 21 cfs from the North Fork River and 7 cfs from the South Fork. A summary of flow-salinity relationships used in determining these criteria is provided below.

North Fork

Results of initial GIS analyses and modeling studies indicate that a flow of at least 70 cfs may be appropriate as a management target for the North Fork of the St. Lucie River. Flows at or below 21 cfs occur in the North Fork during periods when significant harm is occurring in the St. Lucie Estuary.

No evidence has been found to indicate that, under current operation conditions, that oligohaline habitat is being lost beyond the extent of the zone that occurred historically. Under both current (1995 Base Case) and historic (NSM) conditions, loss of the oligohaline zone occurs at a point 8 miles downstream from the Gordy Road structure with a probability of about 20 percent.

South Fork

Preliminary analyses of the limited amount of available information indicate that a flow of 27 cfs may be appropriate as a management target for the South Fork of the St. Lucie River. Flows at or below 7 cfs occur during periods when significant harm is occurring in the St. Lucie Estuary. Although these preliminary results indicate that no impacts are likely to occur in the South Fork as a result of current and proposed management actions, further analyses of this system may be warranted to refine management targets for inclusion in future updates to the MFL criteria. These refinements should include more detailed analysis of basin topography and hydrography; improved modeling of flow from the watershed to the South Fork; and development of a model or mathematical relationship to determine salinity conditions in the South Fork as a function of flow.

St. Lucie Estuary

Net freshwater flows are the sum of surface and ground water inflows minus evaporation. Net freshwater flows to the estuary were at or below zero during 14 months of the 31-year NSM simulation period. During such events, which may persist for 1 to 9 months, it can be expected that the oligohaline habitat will no longer be present in the estuary.

Harm *is defined to occur when net freshwater flows to the estuary system are less than the rate of evaporation for a period of two consecutive months during the dry season.*

Such conditions occurred 5 times during the period of simulation, representing a return frequency of about 6 years under natural system conditions. Because such low flow and no flow events occurred under natural conditions, as well as under present conditions, the extent to which such occurrences constitute "significant harm" to the ecosystem is based on the definition that has been formally adopted by the SFWMD:

Significant harm occurs when freshwater flows to the estuary are less than the rate of evaporation for a period of two consecutive months during the dry season for two or more years in succession.

Such an event did not occur during the 31-year period of simulation for the St. Lucie Estuary under either current (1995 Base Case) or historic (NSM) conditions.

District staff recognize that these definitions are not exact. The concept is based on the presumption that any loss of oligohaline zone habitat beyond what occurred under natural conditions (as simulated by the NSM) represents some degree of ***harm*** to the system. The exact point at which this loss becomes ***significant harm*** cannot be determined without additional study of the hydrology of the system and the resources at risk. Lacking this precise knowledge, the selected approach represents a conservative standard.

Long-Term Management Criteria

In addition to the definition of flow conditions that represent significant harm, District staff also developed recommendations for flows that would provide an improved distribution of oligohaline habitat. The particular location and flow conditions were chosen to represent a significant "breakpoint" in the amount of oligohaline habitat available. Loss of areas downstream from this point means that most of the oligohaline habitat in this system has been compromised. Such incursions may occur fairly often under natural conditions, and it is likely that recovery from such events is rapid and complete within a few months after low-salinity conditions have been restored. Nevertheless, the District recognizes a management goal for this system to provide a more stable base flow and oligohaline habitat as a means to improve productivity of the estuary itself and adjacent coastal and offshore species that depend on availability of this habitat

during part or much of their life cycles. Any MFL criteria that are developed must be consistent with that goal.

ABILITY TO MEET THE PROPOSED CRITERIA

Data and modeling studies indicate that under current (1995 Base Case) conditions, more fresh water is being discharged into the North Fork during dry periods than was discharged historically. This increased flow during low flow periods has resulted in a decreased probability of flows reaching zero cfs or less throughout the estuary. There is no evidence that the proposed significant harm criteria will be exceeded in this system under present conditions.

Examination of the North and South Forks indicates that both of these systems support viable oligohaline habitats. The exact extent and duration of the oligohaline zones in these systems is uncertain. An attempt to model the oligohaline zone in the North Fork indicates that a flow of 70 cfs or more is desired in this system to provide a suitable area and volume of oligohaline habitat. Flows of less than 21 cfs from the North Fork occur during periods when net flow of fresh water to the estuary is zero or less. Flows from the North Fork should be maintained above this level during periods when other sources of freshwater input to the estuary are restricted.

A similar model of the relationship between flow and salinity has not been developed for the South Fork, but empirical calculations indicate that a flow of 27 cfs may be appropriate to maintain a comparable amount of oligohaline habitat in this system. Flows of less than 7 cfs from the South Fork occur during periods when net flow of fresh water to the estuary is zero or less. Flows from the South Fork should be maintained above this level during periods when other sources of freshwater input to the estuary are restricted.

PREVENTION STRATEGY

Since the proposed significant harm criteria are not being exceeded, a recovery strategy does not need to be developed for this system. Furthermore, changes that are proposed for the watershed as part of the Indian River Lagoon Feasibility Study (USACE and SFWMD, 2001) are designed to provide additional retention basins along the river. These retention basins will reduce the amount and frequency of high volume discharges and can potentially provide additional water for discharge to the river during dry periods. With these features in place, the probability of exceeding the proposed MFL criteria may be further reduced.

However, the ability to better manage water in the watershed may also make it possible to capture and retain water from the watershed for allocation to other (e.g., urban and agricultural water supply) purposes. Under such conditions, future dry season flows to the estuaries could be reduced rather than increased. For this reason, the following

management approach is proposed that is intended to ensure protection of the oligohaline zone in the North and South Forks:

- The management objective for the North Fork should be to provide a flow of at least 70 cfs to the river, during the driest months from March through June. The 70-cfs flow is needed to maintain oligohaline habitat in an area that extends from the Gordy Road structure to a point 8 miles downstream. An average dry season flow of perhaps 200 to 300 cfs may be desirable as a *restoration goal*, to provide a more extensive oligohaline habitat that would generally extend from the Gordy Road structure for a distance of 15 miles downstream to Kellstadt Bridge.
- During periods when insufficient water is available to meet these target flows, discharges from the North Fork should be maintained above 21 cfs to reduce the likelihood that significant harm may occur in the St. Lucie Estuary.
- Analyses should be undertaken by the District to develop similar criteria for the South Fork. Current estimates indicate that at least a 27-cfs flow should be provided to this system during the driest months to protect existing oligohaline habitat.
- During periods when insufficient water is available to meet these target flows, discharges from the South Fork should be maintained above 7 cfs, to reduce the likelihood that significant harm may occur in the St. Lucie Estuary.
- Releases of water through the C-23, C-24, and C-44 Canals should not be used as a means to increase the net flow of fresh water to the estuary and prevent harm or significant harm during dry periods. Water released from these sources is generally of poorer quality than water that flows from the rivers. In addition, water from these canals enters the estuary at locations where it provides poor quality oligohaline habitat.
- Studies are under way to collect additional topographic and hydrologic data needed to improve the models that are used in the South Fork Basin. The extent of oligohaline habitat and salinity conditions that are produced by various flow regimes need to be determined. Assessments are also needed to identify particular resources in this river that need to be protected.
- Additional research and monitoring are needed to refine existing data and models and improve the flow estimates for the North Fork. Research priorities are itemized in the next section.

RESEARCH STRATEGY

As previously stated in **Chapter 4**, the District supports the application of the valued ecosystem component (VEC), a resource-based management strategy approach. The VEC approach is based on the concept that management goals for the St. Lucie River and Estuary can best be achieved by providing suitable environmental conditions that will support certain key species, or key groups of species, that inhabit this system. Detailed below are relevant ongoing and anticipated research efforts in support of St. Lucie River and Estuary MFL development (Doering, 2001)

Watershed Modeling

The need for improved watershed modeling is driving a number of research efforts. Better models are being developed, including three-dimensional models, and additional hydrologic and topographic data are being collected to support these models. A water quality model of the estuary is also being developed, primarily to support the SWIM programs for the Indian River Lagoon and the St. Lucie Estuary. This model will also be used to help determine Pollutant Load Reduction Goals (PLRGs) and TMDLs for the St. Lucie Estuary and to assess the effects of the proposed MFL criteria on estuarine water quality.

Salinity Research

During Fiscal Year 2002, the District will initiate an investigation of the North Fork of the St. Lucie River and Estuary. The purpose of the study is to characterize 1) the extent of the oligohaline zone as a function of freshwater inflow, and 2) the spatial and temporal distribution of chlorophyll *a* (phytoplankton) biomass, zooplankton biomass, and larval and juvenile fish. The results will address the use of the North Fork as a nursery area.

The responses of benthic plants and oysters to rapid changes in salinity will be examined in a series of controlled experiments. These experiments will be conducted at the Gumbo Limbo Mesocosm Facility.

Water Quality

The District has a water quality modeling program for the St. Lucie River and Estuary in place. Studies of phytoplankton productivity and respiration and the benthic input of nutrients have been completed as part of this program. Studies to quantify nutrient loads are still under way.

Sediments

The accumulation of fine grained muck sediments in the St. Lucie River and Estuary has been examined in the past. It is presently being revisited in anticipation of large-scale dredging by the United States Army Corps of Engineers.

Adaptive Management

Based on best available information, a minimum flow has been proposed for the St. Lucie River and Estuary with the understanding that more information is needed to refine assumptions used in criteria development. Ongoing and proposed research and monitoring in the St. Lucie River and Estuary watershed is designed to provide data to fill gaps in our understanding of the ecosystem, specifically targeted to the oligohaline zone as a VEC approach. This information will be incorporated into the next generation of hydrodynamic salinity models now under development. Improved models will provide District staff with an opportunity to reevaluate the proposed criteria and refine the St. Lucie River and Estuary MFLs in accordance with District regional water supply plan development.